

Sustainable Intensification of Cereal-Legume-Livestock Integrated Farming Systems in East and Southern Africa

Transforming African agriculture through sustainable intensification



Farmer experimenting with new maize varieties. Photo: C. Njuguna

Africa RISING Program

The US government launched the Feed the Future (FtF) Initiative to establish a foundation for lasting progress against global hunger. Focusing especially on smallholder farmers, particularly women, FtF supports partner countries to develop their agriculture sectors to increase incomes and reduce hunger, poverty, and malnutrition, and to spur economic growth. It is led by the US Agency for International Development (USAID).

As part of FtF, USAID is supporting an innovative multi-stakeholder agricultural research program, Africa Research in Sustainable Intensification for the Next Generation (Africa RISING). The five year program's main objective is to identify and validate scalable options for sustainable intensification of key African farming systems to increase food production and improve livelihoods of smallholder farmers and at the same time conserve or improve the natural resource base.

Africa RISING, launched in 2011, comprises three research for development projects in West Africa, East and Southern Africa, and the Ethiopian highlands that bring together a wide range of research partners from the Consultative Group on International Agricultural Research (CGIAR) and the National Agricultural Research Systems (NARS) to develop

management practices and technology combinations that better integrate crops (cereals, legumes, vegetables), livestock (including poultry), and trees and shrubs in mixed-farming systems. The aim is to enhance whole-farm productivity, improve nutrition, and increase farm incomes. It will also develop innovations that effectively link farmers to markets and input suppliers.

The three projects are:

- Sustainable intensification of crop-livestock based-farming systems in the Guinea-Sudano-Savanna of West Africa – led by the International Institute of Tropical Agriculture (IITA)
- Sustainable intensification of crop-livestock systems to improve food security and farm income diversification in the Ethiopian highlands – led by the International Livestock Research Institute (ILRI)
- Sustainable intensification of cereal-legume-livestock integrated farming systems in East and Southern Africa – led by IITA

The International Food Policy Research Institute (IFPRI) is responsible for monitoring, evaluation, and impact assessment across all three projects.

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Project countries

The project is being implemented in Tanzania, Malawi, and Zambia.

Tanzania

Project sites: The project activities are carried out in Babati and Kiteto districts in Manyara region of northern Tanzania and Kongwa district in Dodoma region, central Tanzania. The action sites were selected to acknowledge agroecological differences, allow appropriate targeting of technologies and strategies, and complement the development efforts of another USAID-supported program, the Tanzania Staples Value Chain (NAFAKA) project.

Challenges: The key constraints to higher agricultural productivity identified in these areas include poor soil fertility, limited access to improved seeds, climate variability, pests and diseases, low mechanization, weak research-extension-farmer linkages, insufficient knowledge about healthy human nutrition, inadequate agro-processing, and poor markets.

In livestock production, the challenges include unavailability of improved breeds and better pasture and fodder species, overstocking, pests and diseases, conflicts between livestock keepers and farmers, and wildlife-livestock conflicts among others.

Africa RISING will, through a participatory approach, prioritize the challenges and address them over time, allowing the sequencing and targeting of technologies to continually enhance farm-level outcomes.

Project interventions

Through participatory action research, the project is identifying and testing the best practices for integrating crops and livestock, land management, and linking farming and marketing to nutrition and health. These practices will then be widely disseminated by development partners for scaling up and wider adoption in the project area and beyond to significantly impact on food security, nutrition, farm incomes, and environmental sustainability.

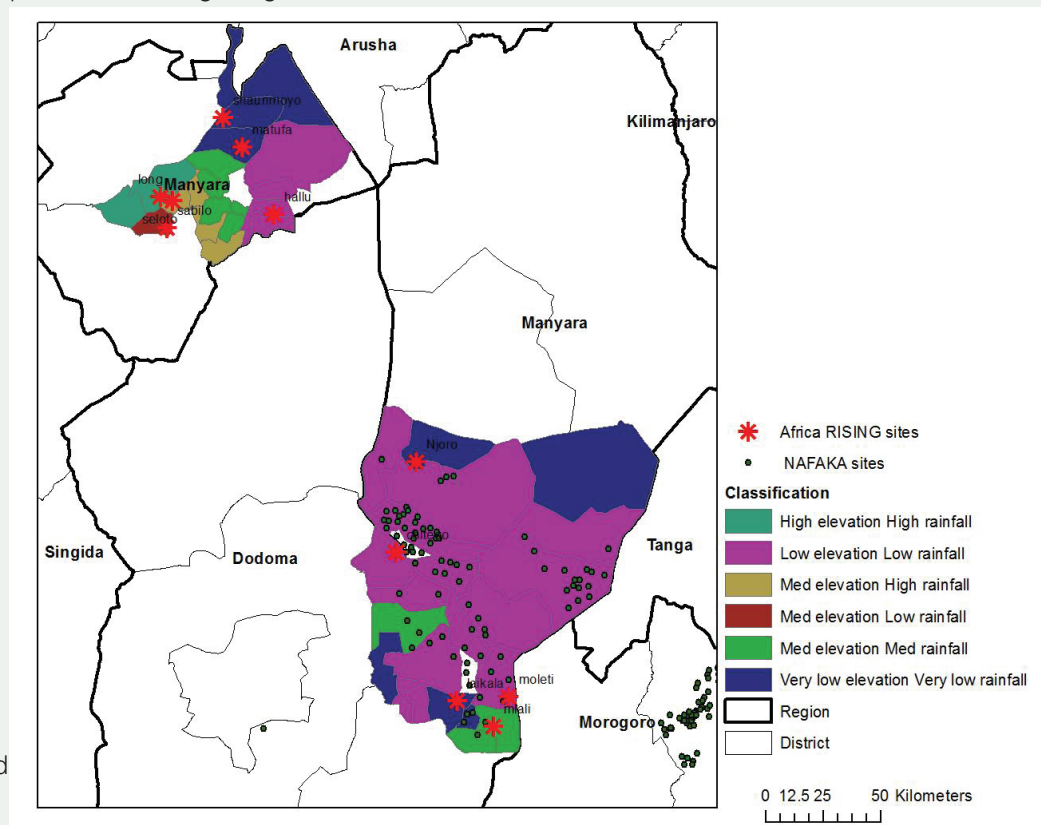
These practices comprise of single technologies or varied combinations of:

- High yielding, disease resistant and drought tolerant, multi-purpose, nutritious and marketable food and feed crops identified through participatory selection. These include maize, sorghum, millet, beans, pigeon pea, groundnut, and fodder plants.

- Integrated soil fertility management practices such as efficient application of organic and inorganic fertilizers and/or integration of legumes in the crop rotation.
- Postharvest processing, utilization, and nutrition technologies to reduce food loss, increase shelf life and market value of farm produce. Special focus is being given to ensure food safety by addressing mycotoxin contamination.
- Land management technologies that conserve water and soil such as rain water harvesting, rain use efficiency, and controlling soil erosion.
- Crop-livestock (and poultry) integration to enhance their productivity through introduction of agroforestry based interventions for fodder and pasture quality management.

Partners

- International Institute of Tropical Agriculture (IITA) – coordinates activities in Babati district
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) – coordinates activities in Kongwa and Kiteto districts.
- Others: International Centre for Tropical Agriculture (CIAT), International Maize and Wheat Improvement Center (CIMMYT), International Livestock Research Institute (ILRI), World Agroforestry Centre (ICRAF), World Vegetable Center (AVRDC), Selian Agricultural Research Institute (SARI), Wageningen University, International Food Policy Research Institute (IFPRI).
- Supporting NARS partners: Naliendele and Hombolo Agricultural Research Institutes, Sokoine University of Agriculture, University of Dodoma, Pasture Research Centre Kongwa, Nelson Mandela African Institute of Science and Technology, Tanzania Livestock Research Institute Tanga.
- Supporting development partners: Tanzania Staples Value Chain (NAFAKA) project and District Agriculture and Livestock Development Officers.



Africa RISING Research Action Sites (villages) in Tanzania

Malawi

Project sites: The project is being implemented in Ntcheu and Dedza districts in central Malawi where maize-based production systems are dominant. Agroecological considerations guided the identification of research action sites.

Challenges: Poverty, food insecurity, and malnutrition are common in the area as a result of low agricultural productivity and over-reliance on low-protein staple cereal crops. Constraints to agricultural productivity include inadequate and outdated extension messages, variable rainfall, and degraded soils.

Project interventions

Africa RISING aims at enhancing farmers' knowledge and supporting intensification for increased productivity in maize-legume farming systems, beginning with integrating technologies that address soil and land degradation.

The research in Malawi is coordinated by Michigan State University and builds on its past successes of promoting legume-diversified farming systems in northern Malawi through participatory action research using 'mother-baby' adaptive trials as platforms for knowledge dissemination.

Mother trials: The researchers set up 'mother' trials on lead farmers' fields to demonstrate an array of existing technologies and technology combinations for sustainable intensification. These are:

- Intensified grain legume production as sole crops in rotation with cereals, or using various maize-legume intercropping options, and a unique intercropping of two grain legumes based on their complementary growth characteristics and plant architecture. This 'doubled-up legume' technology hinges on pigeon pea's unique growth habit compared to the potential understorey companion crops (groundnut, soybean, cowpea, beans) which ensures enhanced soil fertility benefits and grain for better nutrition.
- Soil fertility and soil health management through application of organic, inorganic, or a mixture of both fertilizers, use of cover crops, and short fallow rotation with green manure.

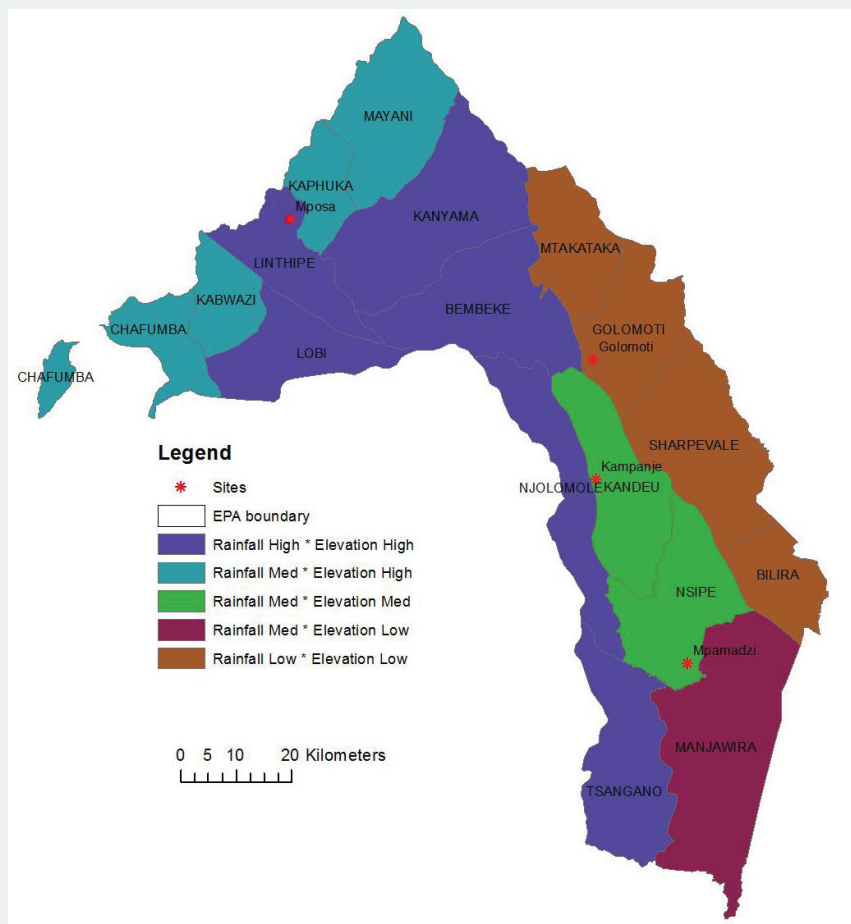
Adaptive baby trials: Members of the farmers' groups involved in setting up the 'mother' trials select their preferred options and set up 'baby' trials for experimentation on their farms.

Livestock integration and intensification:

While the livestock density in Malawi is very low, the project is exploring options for enhancing productivity across the interventions sites among the farmers who own livestock.

Partners

- Michigan State University, Department of Plant, Soil and Microbes – coordinates activities in Malawi



Africa RISING Research Action Sites (sections) in Malawi



Oxen used to transport harvested maize which was intercropped with pigeon pea
Photo: C. Njuguna

- Others: ICRAF, IITA, IFPRI, CIAT, CIMMYT, Lilongwe University of Agriculture and Natural Resources (LUANAR), Wageningen University
- Development Alternatives Inc/Integrating Nutrition into Value Chains (DAI/INVC) as development partner
- Department of Agriculture and Extension Services

Zambia

Project sites: Katete and Chipata districts in Eastern province

Challenges: Low soil fertility, frequent droughts, limited use of high yielding varieties and inorganic fertilizer, lack of capital and assets to invest in improved production methods.

Project interventions

Africa RISING has formed a strategic partnership with the SIMLEZA (Sustainable Intensification of Maize-Legume Systems in Eastern province of Zambia) project, led by CIMMYT and IITA.

The SIMLEZA-Africa RISING research activities aim at:

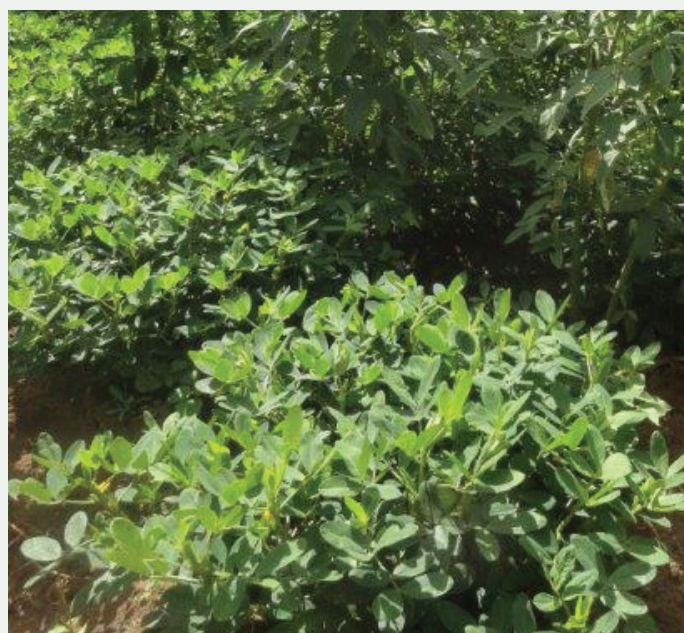
- Enhancing technology targeting and delivery for the poor by identifying systematic constraints and options for improving input and output value chains and impact pathways.
- Enhancing the adoption and adaptation of productive and resilient agronomic practices and facilitation of local innovation systems for intensification and income growth in maize-legume cropping systems.
- Enhancing the diversification of soybean use at household level through processing and product development.
- Increasing the range of maize and legume varieties through participatory testing, release, and enhanced delivery of seeds of locally adapted varieties.
- Enhancing the capacity of national partners on targeting, technology adaptation, trial management, seed and input supply, and value chain development.

Partners

IITA, CIMMYT, Wageningen University, IFPRI, Zambia Agriculture Research Institute (ZARI), Golden Valley Agriculture Research Trust (GART), University of Zambia (UNZA), Total Land Care (TLC), Ministry of Agriculture and Livestock (MAL)

Emerging activities

To increase the understanding of the implications of sustainable on-farm intensification at the landscape level the project will provide the evidence base for the links between field and farm-scale sustainable intensification interventions and climate change mitigation and biodiversity conservation. This work will be carried out in Eastern and Lusaka provinces under the leadership of Michigan State University, Department of Community Sustainability, with other international and national partners.



Groundnut-pigeon pea doubled-up legume system. Photo: I. Hoeschle-Zeledon

"Through this project we want to increase the productivity of smallholder farms while paying careful attention to avoid any negative environmental impacts and also address some of the challenges smallholder farmers are currently facing due to climate change. We want to use science to bring about a Green Revolution but avoid the negative consequences that are often overlooked."

— Dr. Jerry Glover, USAID Senior Sustainable Agricultural Systems Advisor

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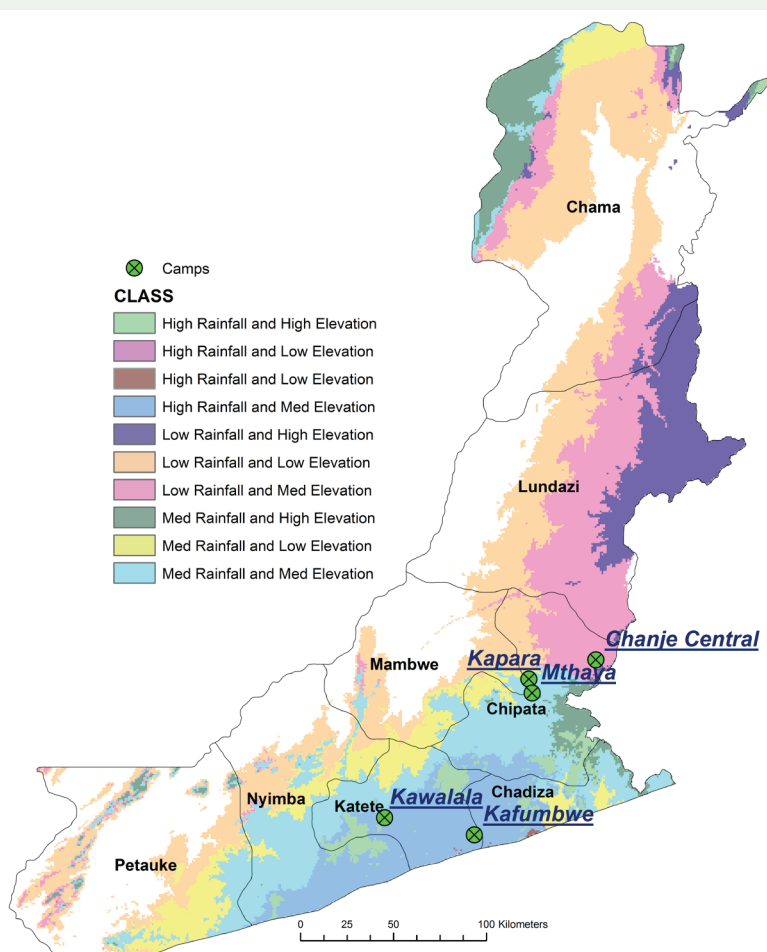
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SIMLEZA-Africa RISING Research Action Sites (camps) in Zambia